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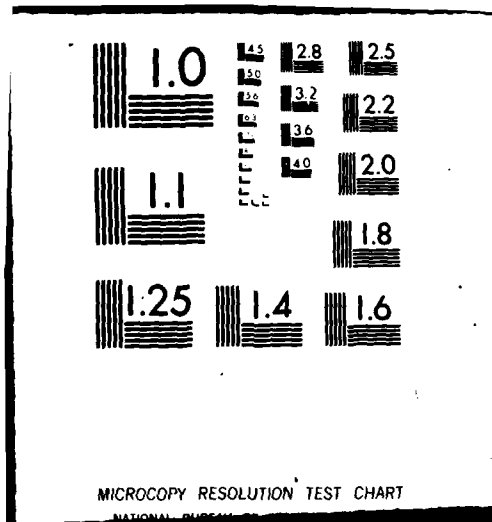
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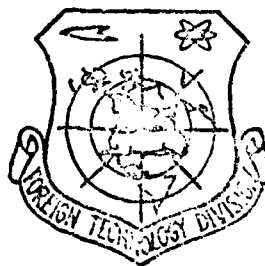
FOREIGN TECHNOLOGY DIVISION



THE CLIMATOLOGY OF THE MALOJA WIND

by

W. Moerikofer



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THE CLIMATOLOGY OF THE MALOJA WIND



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W. Moerikofer

Davos Physical-Meteorological Observatory

The essay by Frau Klainguti-Schaumann ¹⁾ on anemographic recordings in Engadine gives me grounds to publish the important results of my own wind registrations from Sils-Baselgia as a supplement; these were accomplished in conjunction with pilot ballon launches in the Maloja area, about which Herr E. Moll ²⁾ has reported elsewhere. The recording were conducted by means of a contact anemometers from 22 July to 24 August on the roof of the western-most house of Sils-Baselgia (at the outlet of the Silser Sea) at 1800 m above Sea Level. In addition to the recorded wind speeds, wind direction and the weather were noted with respect to visual observations several times daily; especially on days on which the Maloja wind could be expected, the observations were undertaken particularly carefully. The position of Sils-Baselgia on flat ground between the Silser Sea and the Silvaplana Sea could be particularly favourable for undisturbed Maloja wind recordings.

FOOTNOTES: ¹) H. Frau Klainguti-Schaumann: The Wind Relationships of the Engadine, in Particular the Maloja Wind, I-st Results of the Anemographic Recordings of the Summer of 1936, Meteorological Zeitschrift 54, 289-295, 1937.

²) E. Moll: The Wind Relationships of the Maloja Pass: Double-Sightings of Pilot Balloons in the Bergell, Contribution to Phys. d. fr. Atmosphere [?Physik der freien Atmosphaere?] 25, 1938

In this period Maloja wind of longer or shorter duration was noted on a total of 16 days. So as to sift out the typical regularity, for the subsequent formation of the mean of these 16 days, all those which displayed strong irregularity were disregarded, endured until long into the night, or transitioned into gradient wind or onset of bad weather. In this manner, only seven days of Maloja wind were left. These were the following, with indication of the start and end of the Maloja wind:

24 July 1935	0930 - 1650 hours
2 August 1935	0915 - 1940 hours
7 August 1935	0945 - 1935 hours
8 August 1935	1010 - 2030 hours
11 August 1935	0940 - 2050 hours
18 August 1935	1030 - 1840 hours
19 August 1935	1155 - 1845 hours.

The incursion of the Maloja wind in general can be diagnosed with high certainty, since after weak air movement the wind sets in abruptly with a few blows. On the average of the seven days the start was at 1005 hours, disregarding ^{19 August} when the Maloja wind onset was indubitably tardy, and with inclusion of a few additional days on which the wind onset occurred without disturbance we find 0930 hours as the average of the onset in this season.

The end of the Maloja wind is harder to determine since it dies down very gradually. The average of the above-given seven days yields

the end at 1915 hours, with selection of the most suitable days at 1940 hours. For the observation period a mean duration of the Maloja wind of some ten hours is thus yielded.

If these times are compared with those recorded by Frau Klainguti-Schaumann at Celerina, then we find that in Celerina, on the average for the July -September period, begins at 1030, with selection of cases appearing typical at 1010. Such a delay of the wind onset by 40 minutes at Celerina in contrast to Sils-Baselgia appears to be quite illuminating, since Celerina lies 12 km further downvalley in the Upper Engadine and the Maloja wind propagates itself downvalley from Maloja.

The mean time of cessation of the Maloja wind at Celerina was found to be 2140; here in contrast to Sils-Baselgia there is a delay of two hours. Such a delay can not be viewed as realistic. The long evening endurance of the daily wind~~at~~ Celerina is explained as Frau Klainguti-Schaumann has already assumed, indubitably by the fact that the actual Maloja wind is reinforced by the slopewinds of the steep Val Saluver outflowing evenings emptying from the West~~and~~ its duration is notably extended.

The same result may be obtained from a comparison of the wind velocities in Sils-Baselgia and Celerina on Maloja wind days. In the

following table the hourly average of the wind velocities in m/s on seven days with respect to my measurements at Sils-Baselgia (July/August 1935) and on twelve days for the work of Frau Klainguti-Schaumann (July/September 1936) are compiled.

Table 1. Hourly mean of the wind velocity in m/s during Maloja wind.

	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12
Sils-Baselgia	2.1	1.7	1.2	1.1*	1.4	1.8	1.9	2.3	1.9	2.7	5.0	5.6
Celerina	1.4	1.0	0.9	0.7	0.6	0.6	0.5*	0.9	1.2	2.3	3.3	5.1
	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24
Sils-Baselgia	7.2	8.2	7.6	7.2	7.2	6.1	4.6	3.9	2.6	2.1	1.5	1.6
Celerina	7.0	8.2	8.8	8.6	7.6	7.4	6.7	5.8	4.3	3.3	2.5	1.5

Due to a noteworthy coincidence in Table 1 the twenty-four hour average for the two stations are the same (3.7 m/s), the ratio of morning to afternoon, however, significantly different. In the hours of night until 0900 the wind velocities at both locales are low, but somewhat stronger at Sils, which is explained by the free position of the station on the valley floor. From the onset of the Maloja wind to its maximum (1400) we also had constantly higher velocities than at the Celerina station which lies on the left-side of the valley slope and is somewhat protected by the cross-valley barriers of St. Moritz. From 1400 on, however, the relationship reversed and Celerina had wind velocities 1-2 m/s higher than Sils; In particular near evening, where the sun leaves the valley early due to the high mountains to

the west, the reduction of the wind velocity in Celerina is significantly slower than at Sils, and also after the incursion of night there are still relatively high wind strengths here. Also this comparison of the daytime pattern of the of the wind velocity at Sils-Baselgia and Celerina reinforces the assumption that the relative high wind speeds which were measured in Celerina on days with Maloja wind, are not to be traced back solely to the Maloja wind, but rather that thereto the descending slope winds which set in with the shadowing of the steep western slope are involved with a significant component. Also the appearance as well as subjective experience speak for the fact that the typical Maloja wind can be observed most undisturbedly in the Upper Engadine lake region between Maloja and Campfer. Thus the experience that the Maloja wind blows almost constant in this region on good weather days is covered, while Frau Klainguti-Schaumann already in Celerina, behind the cross-valley barriers of St. Mortiz, has almost as frequently found the counterwind, the "Bruscha" which flows upvalley.

In conclusion, the recording results from Sils-baselgia and Celerina should still be compared with the results of the wind observations which I conducted in late Summer, 1918, at Muottas-Muaigl, 700 m above the Engadine Valley floor '). From my earlier observations, where a clear delay of the Maloja wind onset and a prematurity of the its decrease from Summer to Autumn had been

established, makes possible the calculation that for the observation period of Sils and similarly for those from Celerina, the onset at Muottas=Muraigl would have fallen at some 1100 and the end at about 1800 hours. At the altitude of 700 m above the valley floor the start of the Maloja wind thus falls some one-half to of an hour later than at Celerina, which lies at the foot of Celerina. Obviously the Maloja wind does not set in exactly simultaneously over the entire high expanse, but rather first over the valley floor and then increases its might relatively quickly. That at Muottas-Muraigl the Maloja wind sets in one-and-one-half hours later than in Sils is explained chiefly from the differing positions of the two sites with respect to the direction of propagation of the Maloja wind.

FOOTNOTE: ³) W. MOERIKOFER: Observations on the Theory of the Maloja Wind, 63-d Annual of Naturf. Ges. of Grisons, Pp. 69-101, 1924.

The decrease of the Maloja wind occurs at Muottas-Muraigl 1-1/2 hours earlier than at Sils and 3-4 hours earlier than in neighboring Celerina. Therefrom it is possible to assume that the end of the actual Maloja wind is accelerated by the down-slope wind of the

Muottas-Muraigl Hill which sets in at 1800 hours, while at Celerina an extension of the Maloja wind is simulated by the outflowing slope wind of the Val Saluver. Accordingly, of the three observation locales, Sils could have the true Maloja wind: the Maloja wind at Muottas-Muraigl is shortened by the evening slope wind, at Celerina apparently extended.

Finally, if the wind speeds recorded earlier at Muottas-Muraigl are compared with those at Sils, then it is found that in Sils the mean velocity of the Maloja wind lies between 6 and 8 m/s, those of the diurnal hourly maximum between 8 and 10 m/s. In contrast thereto the corresponding mean speeds at Muottas-Muraigl were found to be 50-100% higher. On the basis of these new comparative figures the values from Muottas-Muraigl could be evaluated with some caution. First, they were only observed with a Wild wind pressure table and then converted into m/s, and thus the wind pressure table had to deliver values which were constantly somewhat too high on the steep slope, where due to the terrain form a considerable upward component of the Maloja wind is unavoidable. On the other hand the fact must be considered that a certain reduction of the flow cross-section is created by the Muottas-Muraigl Hill, which stands somewhat diagonally to the direction of the Maloja wind current, and thus an acceleration of the air flow is created. Additionally, there is the plausible assumption by Moll '), that the high wind speeds observed by me at

Muottas-Muraigl are to be explained by an overlay of the Maloja wind and a normal slope wind in the same direction.

FOOTNOTE: E. Moll: The Wind Relationships of the Engadine, in Particular the Maloja Wind, II-d. Aerological Studies of the Summer 1937, Contribution to Phys. d. fr. Atm. 24, 270-289, 1938.

It can therefore be assumed that the Maloja wind velocities which I had observed at Muottas-Muraigl in 1918 are indeed possibly a small amount too high, but that it lies completely in the realm of probability that these values must be higher than at the valley floor as a result of local influences. On the other hand it is clear that the high wind velocities observed in Muotta-Muraigl can only be valid for this location of local stagnation, while one must count on somewhat lower wind velocities at the same altitude above Sea Level over the valley floor.
